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U1S S1247 S1774

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(58) Field of search
UK CL (Edition L) B2F FKK, F2V VX8
INT CL[5] B05B, F16K, F16L

(54) Check valve and valved nozzle

(57) A pipe connector 1, for use particularly with air-blasting equipment, incorporates a check valve 6 which permits fuel flow towards a tool 4 and restricted flow in the opposite direction to relieve pressure within the pipe leading to the tool in the event that the pressure supply is cut off by uncoupling the connector.

The specification also discloses a valved nozzle 14 having a closure member 17 carried by a sleeve member 18 and operated by manual adjustment of the sleeve or by fluid pressure acting on the closed member.

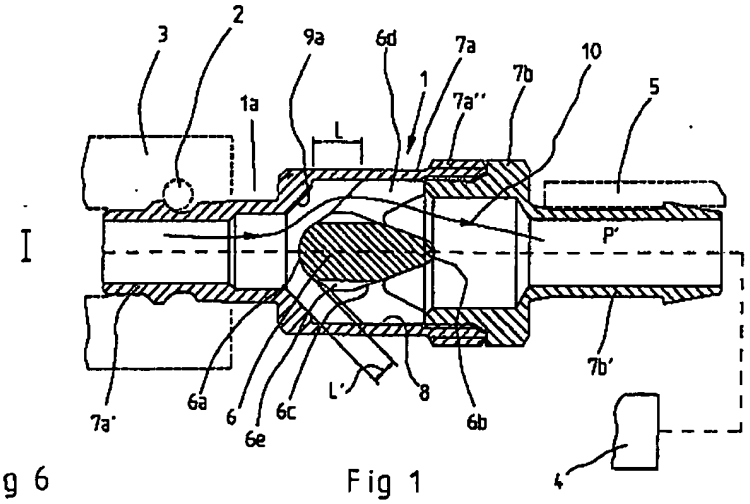

Fig 1

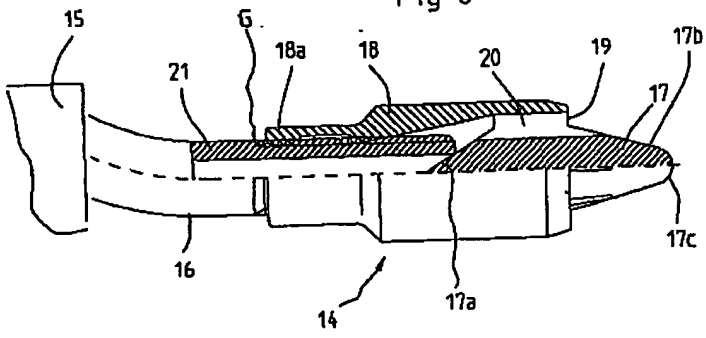

Fig 6

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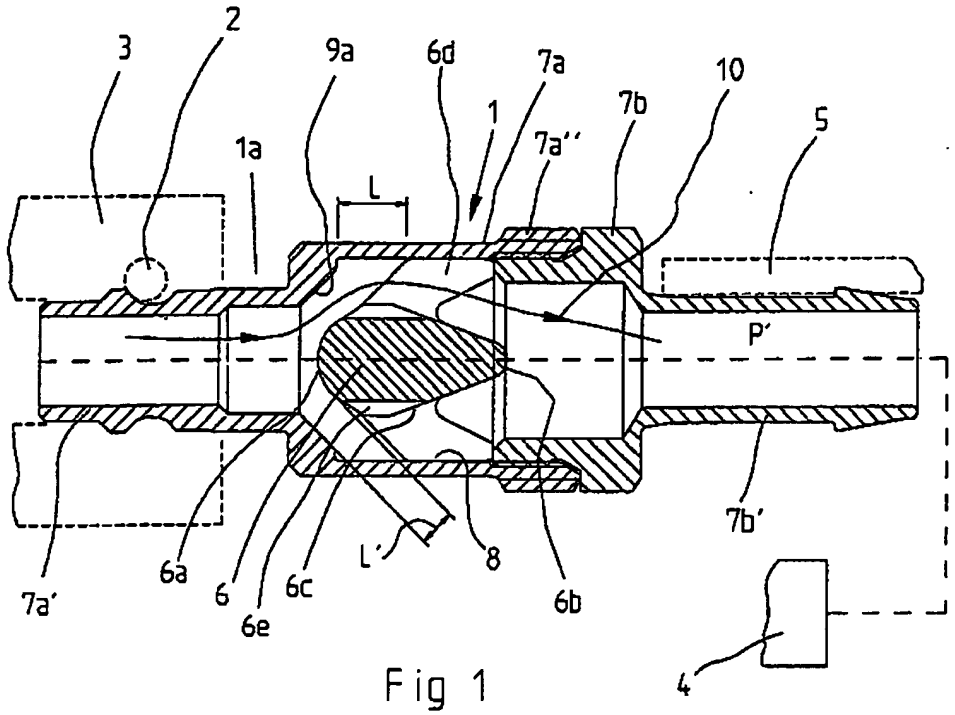
3
2
9a
6d
7a
10
1
7b
5
7a''
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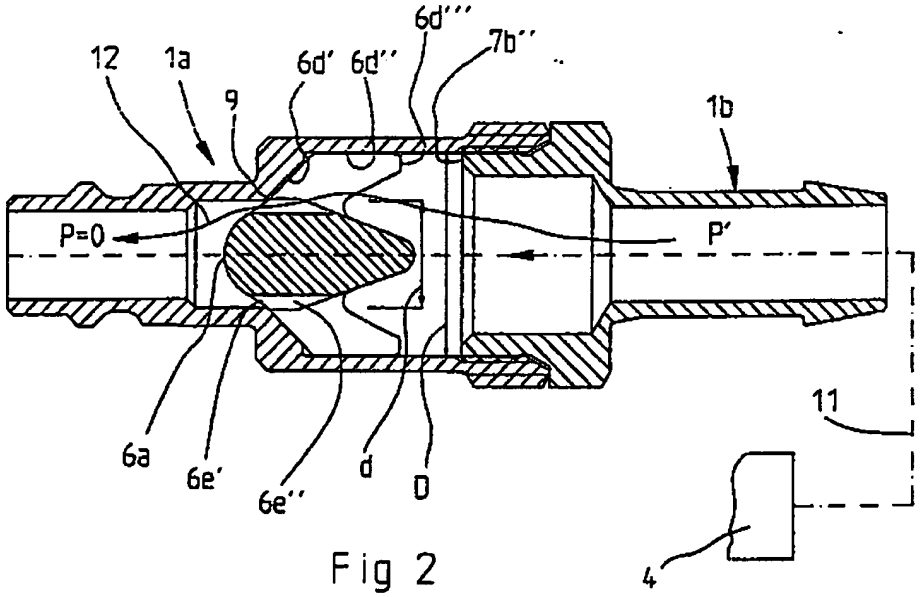
P'
7b'
L'
8
7a'
6a
6
6c
6e
6b
4

Fig 1


6d'''
7b''
12
1a
6d'
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9
1b
P=0
P'
11
6a
6e'
6e''
d
D
4

Fig 2

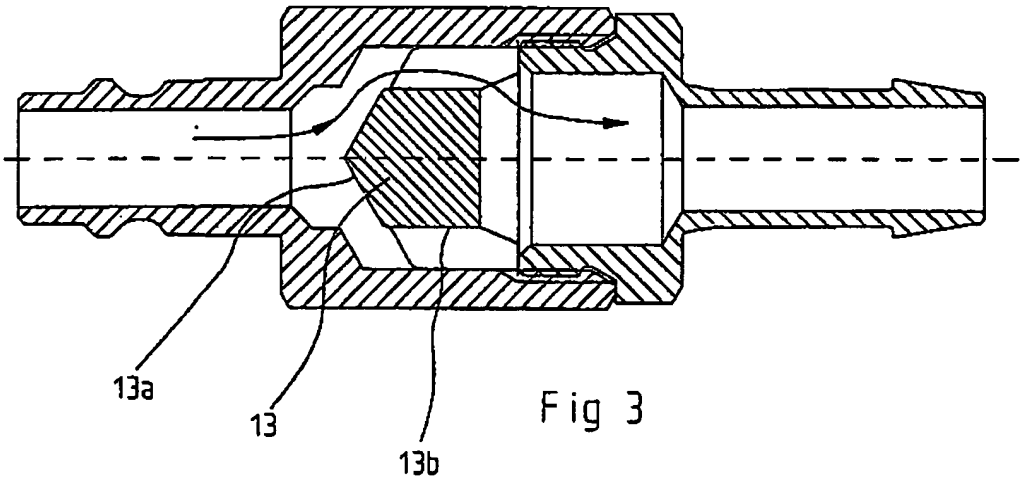


Fig 3

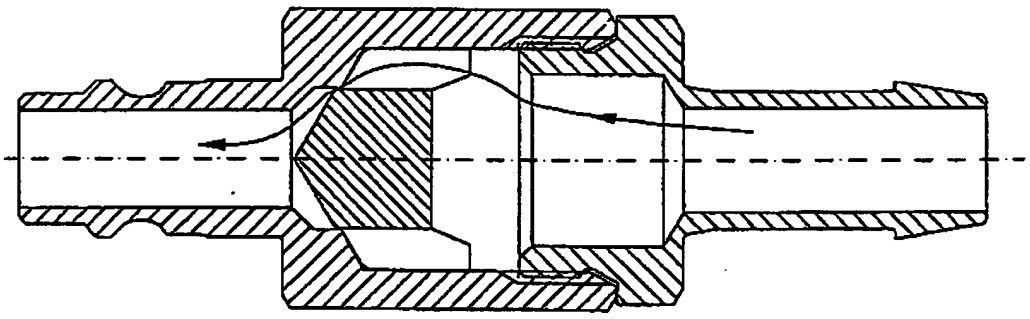


Fig 4

Fig 6

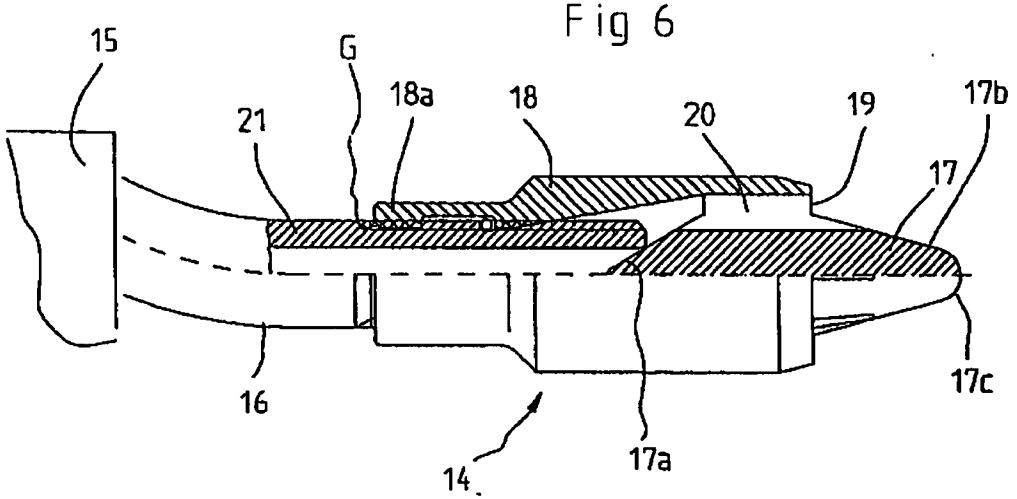


Fig 5a

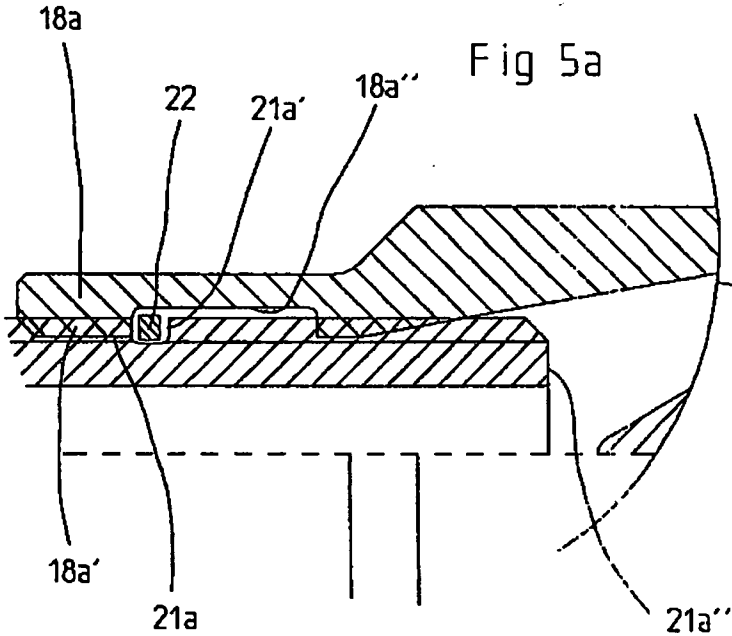
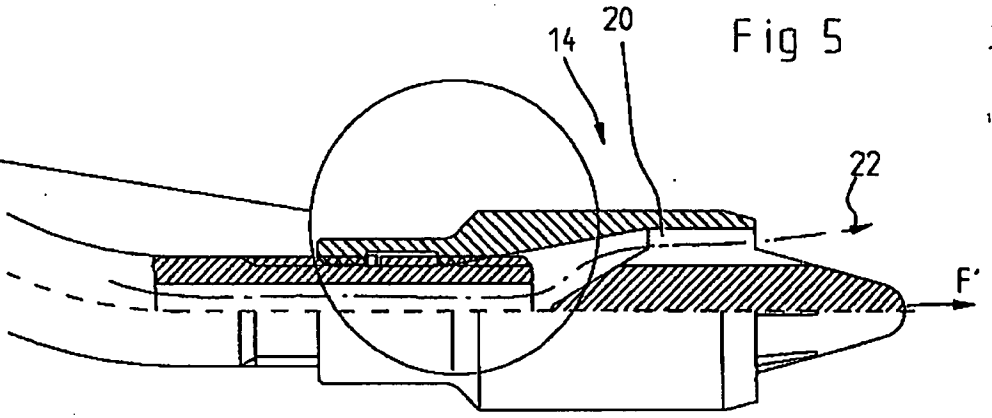


Fig 5



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ARRANGEMENT IN A MEDIA-CONDUCTING UNIT

TECHNICAL FIELD

The present invention relates to an arrangement in a media-conducting unit in or on which a first part acting on the media conduction is mounted in a longitudinally displaceable manner in relation to a second part. The said unit can consist of a quick-coupling unit which can be connected to a pressure source with quick-coupling function, a mouthpiece and so forth.

PRIOR ART

Quick couplings with displaceable inner parts are already well known. However, the present unit is to be used in connection with a pressure source, preferably for air, with the aid of which tools, elements etc., are to be operated. The unit in this context supplies the media in question, which are conducted via a hose from the unit to the tool in question or the like. The unit can also consist of a nozzle, for example a nozzle for air blasting. The nozzle in question can in this context be connected to a suitable pressure source via a hose or another line.

ACCOUNT OF THE INVENTION

TECHNICAL PROBLEM

In this type of equipment, there is a requirement for the unit in question to be constructed for large media conduction which provides an adequate media supply to the air tool in question or the like. The consumption of media occurs when the tool in question is activated. When the tool is not activated, there is no media consumption and media pressure remains in the connecting line to the tool. Decoupling of the tool is carried out by the connection to the pressure source being uncoupled. It is important in this context that the remaining media in the connection system to the tool are released so that a person observing that the pressure source is uncoupled

is not caught by the tool being set in motion by the unintentional activation of its activating element. It is thus important that the pressure of the confined media is relieved so that the tool cannot be set in motion or function long after the uncoupling of the pressure source has been carried out. The case in which media pressure remains in the feed hose to the tool can bring with it high risks of accidents. It must be possible to relieve the enclosed media within a relatively short time, for example within a few seconds to a few minutes after the uncoupling of the pressure source has taken place. Such a release of media pressure must not cause high sound levels which can damage the hearing or create discomfort from the hearing point of view.

In the case of a nozzle for air blasting, it is also important to achieve high through-flow cross sections in the nozzle while at the same time preventing damaging or uncomfortable acoustic effects due to the outflow of air in the nozzle. The nozzle must be able to operate with a sustained high desired blasting force.

THE SOLUTION

The arrangement according to the invention deals with solving this set of problems. The main characterising feature of the novel arrangement is that the first part mentioned in the introduction is arranged in such a manner that, depending on a pressure change in the media or a relative longitudinal displacement effect between the first and second parts, it takes up an end or shutting-off position where media located behind the first part can pass out to the surrounding atmosphere for relieving the pressure of the media during a predetermined time which produces a low sound level, for example a sound level below 60 dB (decibels), during the said media pressure release or where media enclosed behind the first part due to the displacement of the first part are prevented from passing to the surrounding atmosphere or only pass to the surrounding atmosphere to a limited

extent.

In one embodiment of the novel arrangement, the first part is constructed with an essentially bobbin-shaped hub body and wings projecting from this by means of which the first part is mounted in a longitudinally displaceable manner on an inner wall in the second part. On connection of the unit to a pressure source which, via the unit, is intended to supply power to elements (tools), which can be activated by media pressure and which are also connected to the unit, the first part assumes a first position in which maximum media conduction can be effected. When the unit is uncoupled from the said pressure source, the first part assumes the said end position due to the pressure in the media which is present behind the first part at the said uncoupling. The passing out of the media behind the first part to the surrounding atmosphere, produced in the end position, entails a release of pressure towards the element or elements which can be activated by media pressure, which elements are thereby prevented from carrying out their functions after the uncoupling of the pressure source.

In a further embodiment, the unit can be connected to a pressure source and the element or tool which can be activated by media pressure via first and respectively second connection ends on the unit. The larger end of the bobbin-shaped hub body is directed towards the pressure source and its narrowing end towards the said element.

In a further embodiment, the second part is constructed with a seat part and a first part can interact with the seat part at its larger end. One or more recesses for passage of the media in the said end position are arranged between the body and the seat part. In a further embodiment, the bobbin-shaped body is constructed at its larger end with one or more slots or depressions located outside, via which the passage of media can be effected in the said end position. The larger end of the bobbin-shaped hub body and the front

edge of the wings, or corresponding elements, protruding from the body are arranged in such a manner that the front edges of the wings protrude essentially tangentially from the front part of the said larger end and the said front edges slope backwards/upwards seen from the larger end. The back ends of the wings can in this context extend backwards to essentially the same level as the back part of the narrowing part of the hub body. The bobbin-shaped hub body can also be constructed with an essentially conical back part and the back edges of the wings can then extend from the centre parts of the conical back part.

In a preferred embodiment, the said slots or recesses preferably extend axially on the outside of the bobbin-shaped hub body and between a position in front of the front edges of the wings to a position slightly in front of, or at the same level as, the back edges of the wings at their attachments to the bobbin-shaped hub body, in addition to which the seat part in the second part effects a spread-out seat function with a spread-out contact area for the front edges of the wings, and that in the said end position, the said spread-out contact area is present at the same time as parts of the larger part of the bobbin-shaped hub body project past the seat contact area and the said slots or recesses open out on both sides of the seat contact area.

In a further embodiment of the invention, the fixed part can be constructed with a centre part and a cylindrical part arranged on the outside of this centre part and wing-shaped elements or materials connecting the said parts, wherein, in the last-mentioned case, (a) preferably elongated hole(s) for media passage is/are arranged. The cylindrical part extends towards the rear behind the centre part and is mounted in a longitudinally displaceable and sealed manner on the second part. A part directed forward on the second part can interact with a rear part on the centre part in the said shutting-off position which can be effected by means of an external

shutting action produced manually or by means of a spring function.

ADVANTAGES

The arrangement proposed above produces a large media supply capacity with the novel arrangement at the same time as the sound levels can be kept low when the media is passing out of the arrangement to the surrounding atmospheric air. The nozzle can operate with a system pressure of, for example, 2-10 bar.

LIST OF THE FIGURES

An embodiment, proposed at present, of an arrangement which exhibits the characteristic features significant of the invention will be described below, at the same time referring to the attached drawings, in which:

Figure 1 shows in longitudinal section a first embodiment of a coupling unit with an inner first part arranged in a longitudinally displaceable manner in an opening position,

Figure 2 shows in longitudinal section the coupling unit according to Figure 1, but with the first part in an end position, in which a minimised media flow-through is effected from the hose towards the tool in question to the surrounding atmosphere,

Figure 3 shows in longitudinal section a second embodiment of the coupling unit in which the longitudinally displaceable inner part assumes a position which corresponds to the position according to Figure 1,

Figure 4 shows in longitudinal section the coupling unit according to Figure 3 but with the first part in the said second position,

Figure 5 shows in longitudinal section a nozzle for media blasting (air blasting), in which the passage for outflowing media is open,

Figure 5a shows an enlargement of parts of the nozzle according to Figure 5, and

Figure 6 shows in longitudinal section the nozzle according to Figure 5 but with the media passage closed.

DETAILED DESCRIPTION OF THE EMBODIMENT

A coupling unit is shown by 1 in Figure 1. The coupling unit can be connected via a quick-coupling function 2, known per se, to a pressure source T, the connection unit of which (for example female coupling) is indicated by 3. Since the quick-coupling elements are already well known, they will not be described in detail. The connection of the coupling unit 1 to the pressure source can be effected at the first end 1a of the coupling unit. The coupling unit can also be connected to one or more tools 4 which can consist of media-driven tools, for example air-driven tools. The connection to the tools is made via a hose 5, a pipeline system or the like. The coupling unit 1 is provided with a first part 6 which is mounted in a longitudinally displaceable manner in a second part 7a, 7b which can be built of two parts 7a and 7b, respectively, which can be assembled together. The part 7a has an inner wall 8 in which the said first part is mounted in a longitudinally displaceable manner between an open position according to Figure 1 and a position according to Figure 2. The part 7a can be cylindrical and is provided at its one end 7a' with a nipple-shaped part for the said quick-coupling function. At its other end 7a'', the part 7a is coupled together with the part 7b. The coupling together is carried out in a manner known per se and the parts are sealed in a similarly known manner. The part 7b is provided with a nipple part 7b' to provide a possibility for connecting the said hose 5, pipe system or the like. The first part is essentially bobbin-shaped and has its larger hemispherically shaped end 6a directed towards the pressure source T. The narrowed-down end 6b is directed towards the tool 4. The hub-shaped body is also constructed with an essentially conical part 6c. The bobbin-shaped hub body 6 is also provided with wings 6d

by means of which the hub body is mounted against the said inner wall 8. The number of wings can vary, for example between 2-4 and is preferably 3. The hub body is provided with axial slots or depressions 6e located on the outside, the number of which can vary. The number of slots is preferably between 2-10.

In the position according to Figure 2, the hub body extends past a seat 9 arranged in the second part. The said seat is constructed with spread-out contact area for, among others, the front edges 6d' of the wing-shaped elements. In the longitudinal sections shown in Figure 1 and 2, the said front edges extend from the essentially tangential directions of the hemispherically-shaped surface 6a. The front edges extend backwards/upwards and change into axial parts 6d" which interact with the said inner surface 8 of the second part 7a, 7b. The wings are terminated at the rear with end edges 6d"' by means of which the opening position according to Figure 1 can be defined in an interaction with an inner surface 7b" on part 7b. The said slots 6e open out on both sides of the seat 9 according to Figure 2. The openings of the respective slots have been symbolised by 6e' and 6e". In the opening position according to Figure 1, the end 6b of the narrowing part of the hub body assumes a position which lies at the same level as the said inner end surface 7b". The stroke movement of the first part 6 is specified by L. A distance L' between the seat surface 9a and the outer surface of the hub body is selected to provide a large media flow-through in the position shown in Figure 1. On the pressure source side, a media pressure exists which is specified by P. On the tool connection side, the pressure is lower when the element/tool is activated and is specified by P'. The pressure P is higher and the pressure difference P-P' causes the first part 6 to be actuated to assume the position according to Figure 1. The air (the medium) flowing in from the pressure source is indicated by the arrow 10. The media flow-through according to 10 is present as soon as the tool 4 is

actuated and consumes media. The media is deflected on the bobbin-shaped body and the inside dimensions of the coupling unit 1 and the outside dimensions of the first part are selected to produce a media flow-through which is optimum for the size of the coupling unit.

In Figure 2, it is assumed that the pressure source T according to Figure 1 has been uncoupled. This causes the pressure P on the coupling unit side 1a to be equal to 0 (actually the atmospheric pressure). If the tool 4 is left unactuated when the pressure source is uncoupled, media pressure will remain in the connection 11 to the tool. This thus entails that an overpressure P' exists on the other side 1b of the unit. For the media pressure not to remain in the connection 11 for any prolonged time, the venting function according to the arrangement comes into operation. Uncoupling of the pressure source must not cause a strong sound effect. This drawback is eliminated by the design of the coupling unit with the said first part 6. The media pressure can be punctured through the slots 6b during a predetermined desired time which is related to the sound level required to exist on uncoupling the pressure source. The size of the slots as well as the number of slots can thus be included in the determination of the said acoustic effect. The media pressure release can be carried out during a predetermined time which is preferably approximately 30 seconds. After this time, there is no risk that the tool carries out strokes or movements after uncoupling of the pressure part. The pressure difference P' -0 entails that the first part 6 assumes the position according to Figure 2 and that an air outflow according to arrow 12 can be effected via the said slots. The inner seat diameter d is related to the diameter D of the bearing wall 8. These values are significant for optimum media flow-through according to Figure 1. In the present case, D is approximately = 2 x d.

In the embodiment according to Figures 3 and 4, the first part 13 has been given a different design. In

this case, a conical front part 13a changes into a cylindrical part 13b. The cylindrical part carries the said wings which have essentially corresponding extents as those in the embodiment according to Figures 1 and 2. The functions of the embodiment according to Figures 3 and 4 essentially correspond to the functions of Figures 1 and 2.

In the embodiment according to Figures 5, 5a and 6, a media blow-out nozzle is shown. The nozzle is shown as 14 and is connected to a symbolically indicated pressure source 15 via a pipe 16, a hose, a connection system or the like. The first part according to the above in this case consists of a centre part 17 and a cylindrical part 18 surrounding this centre part, and an element 19, connecting these parts 17 and 18, which element can be constructed of wing-shaped elements or of material in the nozzle shell. The nozzle is provided with a number of axial holes 20 which extend from the inside of the nozzle to the surrounding atmosphere. The part 18 is in this case mounted on the outside of a second part 21 which, in turn, is attached to the hose 16, pipe system or the like. The part 18 is provided at the rear with a bearing part 18a which, in turn, is provided with an interposing rear lip 18a' which is guided in corresponding longitudinal tracks 21a in the second part. The said second part also exhibits a front surface 21a' which constitutes the end wall of the said track 21a. A seal 22 is inserted between an inner surface 18a" on the first part and an outer surface in the said track 21a. The track, lip and seal are thereby arranged in such a manner that the first part 17, 18 is arranged in a longitudinally displaceable manner on the second part 21, with sealing between the parts at the same time being produced by means of the seal 22. In the case shown, the parts 18, 21 have interacting threads G by means of which the mutual longitudinal displacement position of the parts can be adjusted by means of screw movement on the part 17, 18 relative to the part 21. Thus, a controllable blow-out

passage exists.

The centre part 17 shows an inner inclined surface 17a which can be brought into interaction with a front surface or front edge 21a" on the second part. The passage between the pressure source 15 and the atmosphere is closed off in conjunction with this interaction. This interaction is produced when the first part 17, 18 is moved backwards relative to the second part 21, see Figure 6. This interaction can be assumed to exist when the pressure source 15 is uncoupled and an external manual force F (for example produced by the said screwing function), a returning force not specially shown, and so forth, has been applied to the first part relative to the second part. When the pressure source 15 is coupled in, media flow-out occurs if the passage/passages are opened in accordance with the above. In an alternative embodiment, the pressure acts on the said inclined surface 17a and thereby causes a longitudinal displacement force F' relative to the first and second parts. The media can thereby flow out via the holes 20 in accordance with the direction of the arrow 22. The holes 20 are at the bottom sunk down in the nose of the centre part 17. The part 17 has a forwardly directed conical shape 17b which changes into a spherical surface 17c at the front.

The interaction between the forward surface 21a" and the inclined surface 17a occurs in connection with the central parts of the latter.

The units 1, 14 specified above are constructed of metal, alloy, plastic or other durable material.

The invention is not limited to the embodiment shown by way of example above but can be subjected to modifications within the scope of the following patent claims and the concept of the invention.

PATENT CLAIMS

1. Arrangement in a media-conducting unit (1, 14) in or on which a first part (6 or respectively 17, 18) acting on the media conduction is mounted in a longitudinally displaceable manner in relation to a second part (7a or respectively 21), characterised in that the first part is arranged to assume an end or shutting-off position depending on a pressure change in the media or respectively a relative longitudinal displacement action between the first and second parts, in which position media located behind the first part can pass out to the surrounding atmosphere for relieving the pressure (P') of the medium during a predetermined time which causes a low sound level, for example a sound level below 60 dB, during the said media pressure release or, respectively, in which media closed in behind the first part (17, 18) due to the displacement are prevented from passing or pass to a reduced extent to the surrounding atmosphere.

2. Arrangement according to Claim 1, characterised in that the first part (6) is constructed with an essentially bobbin-shaped hub body and wings (6d) projecting from the latter, by means of which the first part is mounted in a longitudinally displaceable manner on an inner wall 8 in the second part (7a, 7b), whereby the first part, on connection of the unit (1) to a pressure source (T), which, via the unit, is intended for supplying power to elements/tools (4) which can be actuated by media pressure and which are also connected to the unit, assumes a first position in which maximum or optimum media conduction can be effected, and the first part, on uncoupling of the unit from the said pressure source, assumes the said end position due to the pressure in the medium existing behind the first part at the said uncoupling, whereby the passing out of the media behind the first part (6) to the surrounding atmosphere produced in the end position, allows a pressure release towards the element/elements which can be actuated by the media pressure, which element/elements is/are thereby prevented

from carrying out its/their functions after the uncoupling of the pressure source.

3. Arrangement according to Claim 1 or 2, characterised in that the unit (1) is connected to the pressure source and the tool which can be actuated by the media pressure via first and respectively second connecting ends (1a and respectively 1b) on the unit (1), and that the larger end (6a) of the bobbin-shaped hub body (6a, 6b, 6c) is directed towards the pressure source and its narrowed-down end (6b) is directed towards the said tool.

4. Arrangement according to Claim 1, 2 or 3, characterised in that the second part (7a, 7b) is constructed with a seat part (9) and that the first part can interact with the seat part at its larger end (6a) and that one or more recesses (6e) for media passage in the said end position are arranged between the body and the seat part.

5. Arrangement according to any of the preceding claims, characterised in that the bobbin-shaped body is designed at its larger end with one or more slots (6e) or recesses located on the outside, via which passage of the media can be effected in the said end position.

6. Arrangement according to any of the preceding claims, characterised in that the larger end (6a) and front edges (6d') of the wings extending from the body of the bobbin-shaped hub body are arranged in such a manner that the front edges of the wings extend essentially in a tangential direction from the front part of the said larger end and that the said front edges slope backwards/upwards as seen from the larger end (6a).

7. Arrangement according to any of the preceding claims, characterised in that the rear ends of the wings extend backwards to essentially the same level as the back part of the narrowed-down part (6b) of the hub body.

8. Arrangement according to any of the preceding claims, characterised in that the bobbin-shaped hub body is constructed with an essentially conical rear part (6c) and that the back edges of the wings extend from the essentially central part of the conical rear part (6c).

9. Arrangement according to any of the preceding claims, characterised in that the said slots (6e) or depressions extend preferably axially on the outside of the bobbin-shaped hub body and between a position in front of the front edges of the wings to a position slightly in front or at the same level as the rear edges of the wings, at the attachments of the latter to the bobbin-shaped hub body, and that the seat part (9) in the second part effects a spread-out seat function with a spread-out contact area for the front edges (6d') of the wings, and that, in the said end position, the said spread-out contact area is present at the same time as parts of the heavier part (6a) of the bobbin-shaped hub body project past the seat contact area (9, 9a) and the said slots or recesses open out on both sides of the seat contact area.

10. Arrangement according to Claim 1, characterised in that the first part (17, 18) is constructed with a centre part (17) and a cylindrical part (18) and wing-shaped elements (19) or materials connecting the parts, whereby, in the last-mentioned case, (an) elongated hole(s) (20) for media passage is/are arranged, that the cylindrical part extends backwards, behind the centre part and is longitudinally displaceable and mounted sealed on the second part (21) and that a forwardly directed part (21") on the second part (21) can be interacted with a rear part (17a) on the centre part (17) in the said shutting-off position which can be effected by means of a shutting action (F) produced externally manually or by a spring function.

11. An arrangement for a media-conducting unit substantially as herebefore described with reference to, and as shown in the accompanying drawings.

Amendments to the claims have been filed as follows

1. A medium-conducting unit comprising a first part arranged in or on the unit for controlling the medium throughflow to an associated tool or equipment, said first part being longitudinally displaceable in relation to a second part, characterised in that the first part is arranged, in dependence upon relative displacements between the first and second parts, to adopt at least one opening position and a second end position; and in that an exhaust passage is associated with the opening position to provide a large exhaust area; the arrangement being such that when the two parts are in said second position flow of medium through said exhaust passage is reduced or prevented.

2. A unit according to Claim 1, wherein said first and second parts in their end position are arranged to provide a reduced flow of medium therethrough in such a manner that a low sound level up to approximately 60 dB is emitted.

3. A unit according to Claim 1 or 2, characterised in that the first part is constructed with an essentially bobbin-shaped hub body and wings projecting therefrom, by means of which the first part is mounted in a longitudinally displaceable manner within an inner wall of the second part, whereby the first part, on connection of the unit to a pressure source, assumes said first position, and the first part, on uncoupling of the unit

from the said pressure source, assumes said end position due to the pressure in the medium existing behind the first part at the said uncoupling.

4. A unit according to Claim 3, characterised in that the unit is connected to the pressure source and an associated tool or equipment via first and respectively second connecting ends on the unit, and that the larger end of the hub body is directed towards the pressure source and its narrowed-down end is directed towards said tool or equipment.

5. A unit according to Claim 3 or 4, characterised in that the second part is constructed with a seat part, that the hub body can interact with the seat part at its larger end, and that one or more openings are arranged between the body and the seat part for medium flow when said first and second parts are in said end position.

6. A unit according to Claim 5, characterised in that the hub body is designed at its larger end with one or more slots or recesses located on the outside to provide said openings.

7. A unit according to any one of Claims 3 to 6, characterised in that the larger end of the hub body and front edges of the wings extending from the body are arranged in such a manner that said front edges of the wings extend essentially in a tangential direction from the front part of the said larger end of the body and that the said front edges slope rearwardly and outwardly with respect to said larger end.

8. A unit according to Claim 7, characterised in that the rear edges of the wings extend rearwardly to essentially the same extent as the rear part of the narrowed-down end of the hub body.

9. A unit according to Claim 7 or 8, characterised in that the hub body is constructed with an essentially conical rear part and the rear edges of the wings extend from substantially the central part of said conical rear part.

10. A unit according to Claim 6, characterised in that the said slots or depressions extend axially at the periphery of the hub body and between a location from in front of the front edges of the wings to a location slightly in front of or the same as the connection between the rear edges of the wings onto the hub body, that the seat part in the second part effects a spread-out seat function with a spread-out contact area for the front edges of the wings, and that, in the said end position, the said spread-out contact area is present at the same time as parts of the larger end of the hub body project past the seat contact area and the said slots or recesses open out on both sides of the seat contact area.

11. A unit according to Claim 1, or 2, characterised in that said first part is arranged to be longitudinally displaceable by manually effected actuations, and that said first part is constructed with a centre part and a cylindrical part, and wing-shaped elements or materials connect these parts.

12. A unit according to Claim 11 and in which materials are provided to connect said first and second parts, characterised in that at least one elongated bore for medium flow is provided, that the cylindrical part extends rearwardly, behind the centre part and is longitudinally displaceable and sealingly mounted on the second part, and that a forwardly directed part on the second part is arranged to interact with the rear end of the centre part in the said end position which can be effected by means of a shutting force produced manually or by a spring function.

13. A unit according to Claim 11, or 12, characterised in that the cylindrical part at its rear end is provided with a bearing which in turn is provided with a lip or shoulder arranged to be guided in a groove extending in the length direction in said second part.

14. A unit according to Claim 13, characterised in that the second part has a front surface which comprises the end wall of said groove.

15. A unit according to Claims 13 or 14, characterised in that a seal is provided between an inner surface on said first part and an outer surface of said groove.

16. A unit according to Claim 15, characterised in that the groove, the lip or shoulder and the seal are arranged whereby said first part is displaceable on the second part and sealed by the seal during this displacement.

17. A unit according to any one of Claims 11 to 16, characterised in that the first and second parts are

provided with interactable threads for adjusting the displacement of these parts, and hence said opening and end positions.

18. A medium conducting unit constructed, arranged and adapted for use substantially as hereinbefore described with reference to Figures 1 and 2, 3 and 4, or 5 and 6 of the accompanying drawings.

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Relevant Technical fields

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(i) UK Patent Office

(ii)

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Documents considered relevant following a search in respect of claims 1, 10, 11

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1504206	(EGGERT)	1
X	GB 0896537	(TESTAR & SWAIN) - see Figures 2 and 3	1
X	EP 0194039 A1	(BRITISH PETROLEUM)	1
X	WO 92/18260 A1	(SKANNERUP) - see Figure 3	1
X	US 4930704	(CHEN) - see Figure 3	1, 10

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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(ii)

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Documents considered relevant following a search in respect of claims 1-11

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X P	GB 2249610 A (DUNN)	1
X	GB 2116293 A (DOWTY MINING EQUIPMENT)	1, 2
X	GB 1529614 (CARRIER CORP) See Figures 2 & 3	1, 2
X	US 4703774 (SEEHAUSEN) See Figures 4,5 & 8	1
X	US 4643222 (WISER) See Figure 1	1, 2

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